The Wet Bridge Transfer System: An Novel In Vitro Tool for Assessing Exogenous Surfactant as a Pulmonary Drug Delivery Vehicle

**Background:**
Due to its complex branching structure, direct drug delivery to the remote areas of the lung is a major challenge. Consequently, most therapies, such as those treating pulmonary infection and inflammation, must utilize large systemic dosing, with the potential for adverse side effects. A novel alternative strategy is to use exogenous surfactant, a material capable of distributing throughout the lung, as a pulmonary drug delivery vehicle.

**Objective:**
Utilize an *in vitro* transferring system to assess exogenous surfactant (BLES) as a pulmonary delivery vehicle for different therapeutics.

**Methods:**
An *in vitro* technique was developed to simultaneously study surfactant delivery and drug efficacy. This Wet Bridge Transfer system consisted of two connected wells in which drugs were instilled into an administration well and function was tested in a remote well. The distal wells were seeded with either bacteria or stimulated macrophages. Then therapeutics were administered to the administration well alone or in combination with BLES. Outcomes involved spot plating for bacterial killing and cytokine analysis for anti-inflammatory effects.

**Results:**
Administering any of the antimicrobial or anti-inflammatory drugs alone to the administration well elicited no change for outcomes in the remote well. However, bacterial growth was significantly reduced by several BLES/antibiotic preparations. Similarly, a few BLES/anti-inflammatory mixtures significantly lowered the pro-inflammatory cytokine concentrations in the remote well.

**Discussion:**
The Wet Bridge Transfer system can be used to rapidly assess and screen surfactant-based therapies prior to their assessment *in vivo*. Furthermore, our results indicated that exogenous surfactant was an effective delivery vehicle for many antimicrobial and anti-inflammatory therapeutics.